623/13
3-1
10/1967

The BULLETIN

of the DOW CORNING CENTER FOR AID TO MEDICAL RESEARCH

VOLUME 9 NUMBER 4 MIDLAND, MICHIGAN OCTOBER, 1967

Silicone capping of nerve stumps in the problem of painful neuromas

K. Tauras and W. Frackelton. Presented at the Surgical Forum of the American College of Surgeons, Chicago, October, 1967

In an attempt to determine if silicone capping of nerve endings would limit the size and perineural fibrotic fixation of neuromas, both sciatic nerves of 81 rats were sectioned. One nerve of each animal served as a control. The proximal end of the other nerve was capped by Silastic® silicone rubber* in one of three ways: a sheet rolled into a tube, closed at the distal end with a suture and with a suture at the proximal end; a piece of tubing ligated distally only; or a previously prepared cap drawn on over the cut end of the nerve. Each piece of rubber was approximately .005″ in thickness and 10.0 mm long.

Control animals with untreated nerve endings showed, upon histological examination, large neuroma formation and much perineural fibrosis within the surrounding tissue. The silicone-capped nerves with proximal fixation sutures revealed less distal thickening, moderate neuroma formation, and perineural fibrosis in the proximal fixation suture site. The silicone-capped nerves which had no proximal fixation suture showed no distal thickening, minimal neuroma formation, and absence of perineural fibrosis.

Nerve endings of 6 patients with painful neuromas of the hand were capped with the silicone after removal of the neuromas. One acute finger injury had nerves so managed at primary amputation. Five of the post-injury cases have been relieved of neuroma pain now for over 6 months; one has not. The case of primary finger amputation and nerve capping has also been free of pain. The authors conclude that capping of cut nerves with silicone rubber lessens neuroma reaction, relieves pain in some clinical cases, and can be used in acute wounds as a preventive measure against painful neuroma formation.

* For animals the tubing used was .080″ x .090″
For clinical use the tubing was .160″ x .170″.

From the Marquette University School of Medicine, Milwaukee, Wisconsin.

A permanently attached artificial limb

C. W. Hall, R. Eppright, T. Engen, and D. Liotta. Trans Amer Soc Artif Intern Organs 13:329, 1967

Prosthetic limbs at present are dependent upon secondary rather than primary muscle control, although attempts have been made to utilize the primary muscles. Ideally a prosthetic limb appliance would be one with a weight-bearing extension from the bone and functional attachment under control of the primary muscles. There is only one real problem remaining between such a device and realization—the attainment of a permanent intact skin-prosthetic interface.

In 6 dogs and 1 horse, intramedullary metal pins were driven into the tibial canal. Near the distal end a cone of polypropylene with a nylon velour head was molded to the pin. The velour-covered cone was attached to a hinged external prosthesis. Besides the pin, two artificial tendons made of Dacron tape covered with Silastic rubber were sutured to the flexor and extensor tendons in most dogs. Each tendon had Dacron velour bonded to the proximal end for muscle attachment. At the point where the tendons made their exit, the skin was sutured to the velour. The skin was also brought around the polypropylene cone and sutured to a velour washer.

In theory, tissues should grow into the interstices of the fabric thus obliterating dead space and prohibiting sinus tract formation. This has actually been repeatedly achieved in velour-covered conduits emerging from the body through a stab wound. Although the present attempt was not successful because of chewing of the foreign material by the animals, inadequate velour surface at the interface, and poor post-operative care, it is hoped that when these conditions are rectified this project will prove feasible.

From the Baylor University College of Medicine, Houston, Texas.

Silicone rubber in nerve anastomosis

Primary suturing of a nerve, in addition to being technically difficult, often brings about an unsatisfactory result. Two recent papers deal with the use of silicone rubber in an attempt to alleviate these problems.

Direct suture repair in chimpanzees is characterized by gross neuromas, incontinuity, axonal disorganization, indirect spanning, deficient axonal carry-through, and excessive connective tissue buildup. Six variations of technique in suturing were tried and compared[1]: standard epineural suturing, Millipore wrapping, irradiated heterologous collagen wrapping, and 3 kinds of encasement with Silastic silicone rubber. The latter included wrapping the site with a thin Silastic sheet and encasement with either a thick or thin Silastic tube.

All variations gave some degree of improvement over the standard nerve repair. But only with utilization of the thin tubing was there clearly a consistent improvement with loss of neuroma incontinuity, minimal axonal disorganization, direct spanning, 80% axonal carry-through, and longitudinal alignment of the connective tissue without build-up. There was also a more rapid return of critical motor function accompanied by faster motor and sensory conduction times.

A method has been worked out for tightly aligning the cut ends of nerves yet leaving no sutures at the anastomotic site to bring about a foreign body reaction[2]. A thin-walled piece of silicone tubing 2 cm in length is slit longitudinally. By means of sutures pre-placed in the tubing and in the nerves, the stumps are pulled into opposite ends of the tube and fixed to the epineurium so as to place light pressure at the interface. The guiding sutures are then removed. No plaster cast is applied.

Completely successful nerve union by this method took 17 to 20 days in adult

1. Ducker, T., and Hayes, G. A comparative study of the techniques of nerve repair. Presented at the Surgical Forum of the American College of Surgeons, Chicago, October, 1967.
2. Morotomi, T., Okazaki, S. and Mizuta, S. The new method of suturing in traumatic peripheral nerve paralysis. International Surg 48:164, 1967.

Notice: The only purpose of this Bulletin is to disseminate scientific information involving the uses of silicones in various medical practices. We do not advocate use of these materials as "drugs", nor warrant their safety or efficacy. If they are to be employed, it is the responsibility of the user to determine and comply with all FDA regulations.

623/13.11
623/13

rabbits. The anastomosed site looked rather thin but was able to bear tension as well as normal areas. There were no adhesions or penetration from the surrounding sites. Fibers were seen to cross over the resected section. Only fibrillation voltage was seen at 3 weeks but almost normal discharge developed by 8 weeks.

Eight clinical operative procedures involving traumatic paralysis of the ulnar and median nerves were then attempted with success. In these, grasping power increased from 0 kg preoperatively to 10-20 kg within about a year. Discharge in electromyography became almost normal. Results indicate that silicone rubber may well become an important aid to the neurosurgeon.

Endocardial radio-frequency pacemaker. *I. Barr, S. Yerushalmi, L. Blieden, E. Frei, and H. Neufeld. J Thorac Cardiov Surg 53:668, 1967*

A radio-frequency endocardial pacemaker encapsulated in silicone rubber*, is small enough for implanting in the neck. Placement of the transvenous electrodes requires no more than a venous cutdown. Threshold for endocardial stimulation is approximately 4 times less than for epicardial placement. The design permits easy checking of transmitter or power supply and offers the possibility of changing rate, strength, and duration of the pulses as needed or even to stop pacing altogether. Thus far the device has been successfully implanted in 20 dogs. With continuing successes of this type of placement, a thoracotomy may only rarely be necessary for permanent pacemaking.

* Silastic 382 and 372 medical grade elastomers.

From the University of Tel-Aviv Medical School, Tel-Aviv, and the Weizmann Institute of Science, Rehovoth, Israel.

An epicardial synchronous pacemaker lead. *N. Smyth, E. Hirsch, I. Brecher, R. Betancourt, and J. Keller. Ann Thorac Surg 3:119, 1967*

Many patients requiring cardiac pacing are poor candidates for thoracotomy. A synchronous pacemaker has been developed which can be placed epicardially without thoracotomy. Leads, inserted through the subxiphoid transpericardial route, were constructed of helical coil Elgiloy wire lying free in a Silastic tube embedded in a flat sheet of silicone rubber.

Studies up to 8 months in 20 dogs have shown the superiority of a 4 mm open-coil ventricular electrode. Satisfactory atrial potentials and ventricular stimulating thresholds were obtained in dogs and 1 patient so far.

From the George Washington University School of Medicine, Washington, D. C.

A new antithrombotic surface: development and in vitro and in vivo characteristics. *E. Salzman, W. Austen, B. Lipps, E. Merrill, E. Gilliland, and J. Joison. Surgery 61:1, 1967*

After amination through graft polymerization with ethylene imine, heparin has been chemically bonded to both rigid and flexible OH-bearing materials. The heparin remains permanently, even under conditions of high fluid shear. A powerful antithrombotic effect is achieved in vitro without heparin loss and without anticoagulation of the blood by heparin in solution. In vivo implantation of intravascular prostheses with this type of surface has resulted in extended patency. Dialysis membranes constructed of these materials appear to be at least the equal of cellophane in mechanical strength and diffusivity and superior to conventional materials in compatibility with blood.

From Harvard Medical School and Massachusetts Institute of Technology.

Blood clotting problems in the artificial heart devices. *Y. Nose. J of Bio-Med Materials Res 1:151, 1967*

The clotting problem inside the artificial heart is one of the major obstacles to its long-term implantation. Foremost problem site is the valves and next is the junction of any two materials. Ideally the inner surface should be made of a single material which is smooth and seamless. The flow pattern within the device must preclude stagnant areas. To date Silastic 372 medical grade elastomer, Teflon, polyurethane, natural rubber, and polypropylene have been found to be blood-compatible. Currently silicone rubber is considered the best material.

From the Cleveland Clinic Foundation, Cleveland, Ohio.

Experimental evaluation of a rotating membrane oxygenator. *R. Ratan, G. Bennett, P. Bollin, W. McAlpine, and M. Selman. J Thorac Cardiov Surg 53:519, 1967*

A rotating membrane oxygenator permits O_2 flow through capillary tubes immersed in blood which flows by gravity. The blood is agitated by rotation of the Silastic capillary tubes.* Total priming volume for 0.5 sq m of membrane surface is 750 cc. In vitro testing indicates that 5 sq m of this membrane should be adequate for adults. The unit is compact and easy to assemble; membrane leakage has not been a problem because blood flows around and not through the membranes.

* .012" x .025"

From the Institute of Medical Research of the Toledo Hospital, Toledo, Ohio.

COMMENTARY
by S. A. Braley

Those interested in the implanting of foreign materials in the body will welcome the December, 1966 monograph put out by *Current Problems in Surgery* entitled "Use of Artificial Materials in Surgery". The authors, S. A. Wesolowski, A. Martinez, and J. D. McMahon are surgeons involved in the use of such materials. They have gathered as much definitive and modern data on this confusing subject as possible and now are passing it on to others. No attempt has been made to discuss the metallic orthopedic implants. This was a wise decision since the literature on this subject is already extensive and fairly easily accessible. However, the exuberant proliferation of new plastics since World War II has opened up new possibilities in the field of soft tissue replacement. Studies on these materials are difficult to come by and bear little relation to the studies on the metallic structural implants used in orthopedics.

This same use of the new plastics, however, has also opened up new uncertainties. We all remember the unhappy experience with the implantation of paraffin, and for years it was taught as axiomatic that foreign materials cannot be used subdermally. Yet we hear constantly of successful uses of these new materials. Are these reports unsubstantiated? Or are they the result of enthusiasms not investigated in sufficient depth?

To find definitive data on a given plastic implant in a given application, or even to find data that can be extrapolated, is extremely difficult. There have been several attempts at solving these problems: Dr. Harry Grau in Cleveland is keeping a running bibliography of implant references in plastic surgery, and the F-4 Committee of ASTM has a pamphlet on the subject entitled "Plastics in Surgical Implants". A new book on plastic surgery by Smith and Grabb has a chapter on implants used in their specialty. The University of Denver is attempting to set up a reference system for all implant literature.

The new book by Wesolowski et al goes beyond anything now generally available. It not only has a bibliography of over 400 references, but there is also considerable discussion of the subject matter. It is organized into divisions according to the area in the body where the implant is used, permitting easy reference for the specialist.

The authors are to be congratulated on their depth of penetration of this difficult area. Anyone concerned with implant procedures and materials should have this study in his library.

Development of cataract in rabbit eyes following implantation of liquid silicone into the vitreous chambers. S. Mori. Folia Ophthal Jap 16:827, 1965

In the eyes of each of 7 rabbits, about 1 cc of vitreous humor was replaced with an equal volume of silicone fluid of 500 centistokes viscosity. After injection, the silicone bubble contacted the lens. Three cases developed a slight degree of traumatic cataract. It is not known whether this effect was due to the toxicity of the silicone or mechanical stimulation between the silicone and the posterior sac. None of the other animals developed abnormalities of the lens although observations were continued for a year.

From the Department of Ophthalmology, Nagasaki University School of Medicine, Nagasaki, Japan.

Transurethral freezing of the bladder: an experimental study. *R. Gibbons. J Urol 95:33, 1966*

If a transurethral freezing technique could be developed to produce bladder mucosa destruction, it would have therapeutic value in diseases limited to the epithelium. To this end, 33 female dogs were treated with one of two coolants: 95% ethyl alcohol or dimethylpolysiloxane fluid*. Standard method of infusion was into a rubber balloon although in certain cases the silicone coolant was sprayed directly onto the bladder mucosa. Best results were obtained when the silicone fluid was used with the revolving tip within a balloon. But even a standardized technique did not produce predictable or reproducible results. In no case was there 100% mucosal destruction; in only 22% was the slough greater than 75% of the surface. In most instances, this was accompanied by some permanent underlying muscle damage. Further experimental work is necessary.

* Dow Corning 360 medical fluid of 1.5 centistokes viscosity.

From the Johns Hopkins Hospital, Baltimore, Maryland.

The results of urethroplasty using a silicone rubber patch. *N. Sankey and E. Heller. J Urol 97:309, 1967*

Nine patients with severe urethral strictures were treated by urethroplasty using a silicone rubber patch. This had Dacron cloth bonded to it to permit tissue ingrowth for fixation. Six patients have had good results requiring no further treatment. A seventh had a satisfactory result but required a repetition of this procedure. The major problem in the other cases was difficulty of recognition of the strictured area at operation. This should be aided by experience and by use of urethrograms and bougies since sounds are not sufficiently delicate.

In 3 cases the patch did not become immobilized by fibrous ingrowth. Changing the construction technique of the patch would aid this procedure. Despite the failures, 6 patients who were formerly dependent upon urethral instrumentation every 1 or 2 months have now voided freely for up to 26 months. Results show the technique to be sound and further development is planned.

From the University of Colorado Medical Center, Denver.

Treatment of organic impotence by implantation of Silastic penile prosthesis: further evaluation. *R. Pearman. Presented at meeting of Western Section, Amer Urological Asso, Honolulu, June, 1967*

A Silastic silicone rubber prosthesis has been designed for insertion into the impotent penis without interference with nerve, blood supply or erectile tissue. In earlier cases, the prosthesis was inserted into a pocket developed between Buck's fascia and tunica albuginea. Experience has shown that placement of the prosthesis under the dorsal surface of the tunica albuginea is better.

During operation the length of the prosthesis needed is determined by inserting a metal rule into the pocket. The proximal end of the prosthesis is then cut to size and trimmed. It is better left a little short than too long. Use of this prosthesis may be warranted in carefully selected cases of so-called psychogenic impotence. This prosthesis serves only as a crutch which assists but does not replace other necessary factors.

From the University of California Medical Center, Los Angeles.

Evaluation of materials for use as prosthetic heart valve leaflets in a simple biologic model. *E. Hessel II, H. Anderson, and K. Merendino. Ann Surg 164:1013, 1966*

To test materials for use in prosthetic heart valves, rectangular pieces were suspended horizontally across the lumen of dogs' aortas. Included were a fluorocarbon polymer and knitted Teflon fabrics coated with dispersions of Teflon, polyurethane, and silicone rubber. After up to 90 days, evaluations were made according to the amount of deposition.

No material tested appeared ideal. Least objectionable was the Teflon fabric coated with thick layers of silicone rubber or polyurethane.

From the University of Washington School of Medicine, Seattle.

Subcutaneous mastectomy

Incidence of breast cancer is higher than the average in women with chronic cystic mastitis[1,2] The latter is actually more frequent than is clinically evident and may be present in over 50% of all women.

Treatment may be by hormone administration, mechanical support, aspiration or excision. Simple mastectomy usually leaves the patient with an unesthetic result totally unamenable to satisfactory reconstruction. If, however, a complete submammary excision is performed, a cosmetically satisfactory reconstruction can be done with a gel-filled Silastic implant. Under optimum circumstances, it is possible to totally remove the breast tissue and to insert the prosthesis during the same procedure. In the overwhelming majority of cases, however, it is preferable to defer placement of the prosthesis for some weeks. This insures adequate vascularity of the breast envelope; shrinkage and thickening of the skin flaps have time to occur before the second stage. Thus potential malignancies can be extirpated leaving the patient undeformed.

1. Fredericks, S. Subcutaneous mastectomy, a prophylactic and cosmetic operation. Presented at meeting of American Society of Plastic and Reconstructive Surgeons, Las Vegas, Nevada, October, 1966.
2. Taylor, B., Chronic cystic mastitis and subcutaneous mastectomy with insertion of prostheses. Presented at the Fourth International Congress of Plastic Surgery, Rome, October, 1967.

Studies on the stability and protein adsorption characteristics of heparinized polymer surfaces by radioisotope labeling techniques. *R. Falb, M. Takahashi, G. Grode, and R. Leininger. J Biomed Materials Res 1:239, 1967*

In studies using S^{35}-labeled heparin grafted on to polypropylene, silicone rubber, hydrin rubber, and graphite-benzalkonium-heparin (GBH) surfaces, it was found that a 100-Å layer of attached heparin caused the substrate to be nonthrombogenic. After exposure to water, saline and especially plasma much or most of the heparin was lost.

In another series, adsorption of P^{32}-labeled proteins onto unheparinized, quaternary ammonium, and heparinized surfaces was measured. Amounts of albumin, Hageman factor, thrombin, and gamma globulin adsorbed onto heparinized surfaces were equal to or greater than amounts adsorbed onto unheparinized surfaces. Seven times as much thrombin was adsorbed by the heparinized surface as by the styrene-grafted polypropylene surface. If the anticoagulant activity of heparin comes about by formation of a heparin-thrombin complex, it would appear that these heparin-bonded surfaces would have a limited lifetime owing to an eventual complete coverage of the surface with thrombin.

From the Battelle Memorial Institute, Columbus, Ohio.

A chronic non-reactive percutaneous lead system. *K. Vasko and R. Rawson. Trans Amer Soc Artif Intern Organs 13:143, 1967*

A permanent, silicone rubber percutaneous entry system for electrical conductors and tubing consists of a central tube with a flange on each end*. Surfaces covered with Dacron felt and cloth encourage tissue ingrowth for fixation. One flange fits subcutaneously; the other is external. Wires or tubing drawn through 2 access holes and up through the lumen are sealed in place by a silicone adhesive.

No attention whatsoever has been given this entry button after healing. It becomes essentially an integral part of the skin and follows its movement.

* Materials used were: Silastic 382 medical grade elastomer thinned with Dow Corning 360 medical fluid, and Dow Corning medical adhesive silicone Type A.

From the Yale University School of Medicine and the Pierce Foundation Laboratories, New Haven, Connecticut.

Silicones in rhinoplasty

To correct anatomical deviations of the nose, attention must be paid not only to deflections of the nasal septum but also to deformities of the columella, the lobule, and the external cartilaginous and bony nose. Otherwise some of the defects may be left unrecognized and uncorrected with poor results. Silicone sheeting and silicone-coated Dacron knitted cloth have been useful in certain of these corrections[1].

Direct sculpturing of the alar margins[2] is applicable in a variety of deformities and usually is carried out in conjunction with alar base wedge excisions. A thick flat nose can be made to appear thinner merely by raising the bridge and the tip. This can be accomplished most simply by carved Silastic block implants, one along the bridge and one in the columella. These implants are well tolerated if buried carefully.

1. Patterson, C. Reconstructive septonasoplasty. Arch Otolaryng 84:457, 1966.
2. Millard, R., Jr. Alar margin sculpturing. Plast Reconstr Surg 40:337, 1967.

Preliminary evaluation of AMBRL* porous laminate patellar-tendon-bearing prosthesis. *C. Dolan. Interclinic Info Bull 6:13, 1967*

Because of perspiration problems of current impermeable prostheses for amputees, a porous type has been designed. Made of epoxy laminate, a soft distal end is formed of Silastic 385 and 386 medical grade elastomers. The stockinet substrata are impregnated with a resin mixture. Six months of continuous wear on 4 amputees indicate the comfort and wearing qualities to be satisfactory.

*U.S. Army Medical Biomechanical Research Laboratories.

REVIEWS IN BRIEF

Membrane oxygenator for infants. W. Zingg. Trans Amer Soc Artif Intern Organs 13:334, 1967. Oxygen is blown through many lengths of very fine silicone tubing contained within a wide piece of silicone tubing through which the blood flows. Total or partial by-pass is permitted.

Hemodynamic studies with a newly designed auxiliary ventricle in dogs. S. Tjonneland, T. Okura, and A. Kantrowitz. Trans Amer Soc Artif Intern Organs 13:306, 1967. A new spherical shape with a silicone rubber inner septum occupies less space in the chest, permits placement in the ascending aorta close to the heart, and enables blood flow in a more nearly physiologic route. Use in 35 dogs has shown this design to be exceedingly efficient.

Construction of a rigid-case, double ventricle artificial heart. S. Topaz, M. Ameli, S. Morovati, S. Valiathan, B. Brown and V. Gott. Trans Amer Soc Artif Intern Organs 13:294, 1967. The 4-chambered Hopkins heart has air-actuated silicone rubber diaphragms. The epoxy casing is cast in a silicone mold. Intact animals can achieve significant autoregulation of their cardiovascular dynamics, thus reducing need for a complex external control system. Insertion time is under 30 minutes.

An improved catheter for long-term arterial infusion of tumoricidal drugs. G. Reynolds, R. Richie, and J. Foster. Surgery 58:938, 1965. Silicone rubber catheters with a one-way slit valve have had no thrombotic occlusion or leakage during use in 18 patients for up to 3 months. They permit intermittent therapy. When placed in the carotid artery, the neck is freely movable.

In vitro and in vivo flow studies in blood pumps. D. Liotta, D. Wieting, C. W. Hall, J. Ghidoni, and M. DeBakey. Trans Amer Soc Artif Intern Organs 13:280, 1967. Areas of faulty design are clearly indicated by localized and selective fibrin accumulation on the velour lining, showing blood stagnation or severe turbulence at those points. Flow in vitro has also been visualized by suspending natural pearl essence particles in a blood analog fluid exposed to a narrow beam of light.

Plastic arts of mammary enlargement. C. O'Conor. Trans Soc de Cirugia de Buenos Aires, p. 91, Session of May 11, 1967. Autogenous fragments of skin and fatty tissue are efficient for use in cases of hypomastia. Of the available alloplastic materials, the author states that the Cronin prosthesis is the only effective one.

The BULLETIN
of the DOW CORNING CENTER
for AID TO MEDICAL
RESEARCH
Issued Quarterly

SILAS A. BRALEY,
Director

ETHEL G. MULLISON, PH.D.
Staff Associate, Editor

Associated with the
Research Department
Dow Corning Corporation
Midland, Mich. ME 6-8980

BIBLIOGRAPHY

Additional recent references concerning the uses of silicones in medical applications

Billings, T. A holder to facilitate the intravenous injection of mice. Lab Animal Care, October, 1967.

Braden, M. Viscosity and consistency of impression rubbers. J Dent Res 46:429, 1967.

Fomon, S. and Bell, J. Silicones in facial surgery. Arch Otolaryng 84:514, 1966.

Hall, C., Liotta, D., Ghidoni, J., DeBakey, M., and Dressler, D. Velour fabrics applied to medicine. J. Biomed. Mater. Res. 1:179, 1967.

Hessel, E. II, May, K., Jr., Steinmetz, G., Jr., Anderson, H., Dillard, D., and Merendino, K. A prefabricated semirigid tricusp aortic valve prosthesis. J Thorac Cardiov Surg 54:227, 1967.

Kawaguchi, N. and Shimizu, M. Application of polymers to living bodies. Published by Fuji Polymer Industry, Tokyo, Japan, 1967.

Khastagir, B., Erben, J., Shimizu, A., Rose, F., Nose, Y., VanDura, D., Kolff, W. The four-coil artificial kidney for home dialysis. Trans Amer Soc Artif Int Organs, 13:14, 1967.

Leininger, R. Materials science in dentistry, medicine, and pharmacy. J Dent Res, 45:1653, 1966.

Low, H. and Lefemine, A. Acute mitral insufficiency due to jamming of a disc-valve prosthesis. Ann Thorac Surg 4:71, 1967.

Nosé, Y. Blood clotting problems in the artificial heart devices. J Biomed Mater Res 1:151, 1967.

Ritchie, W., Jr., Edlich, R., Breen, J., Molina, J. and Wangensteen, O. Experimental and clinical experience with gastric freezing. JAMA 198:237, 1966.

Rogers, A. and Morris, L. Percutaneous leads for power and control of artificial hearts. Trans Amer Soc Artif Intern Organs 13:146, 1967.

Spira, M., Miller, J., Hardy, S., Gerow, F. Silicone bag treatment of burned hands. Plast Reconstr Surg 39:357, 1967.

Wallace, J. Foreign body reaction to dimethylpolysiloxane (Silastic): report of case. J Amer Dent Asso 75:1, 1967.

Zakharov, V., Fedorov, S. and Bedilo, V. Replacement of the vitreous body with silicone fluid (An experimental investigation). Vestn Oftal 78:83, 1965.